Abstract Submitted
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Nonlinear stability, bifurcation and resonance in granular plane Couette flow PRIYANKA SHUKLA, PhD Student, MEHEBOOB ALAM, Prof. — A weakly nonlinear stability theory is developed to understand the effect of nonlinearities on various linear instability modes as well as to unveil the underlying bifurcation scenario in a two-dimensional granular plane Couette flow. The relevant order parameter equation, the Landau-Stuart equation, for the most unstable two-dimensional disturbance has been derived using the amplitude expansion method of our previous work on the shear-banding instability.[1] Two types of bifurcations, Hopf and pitchfork, that result from travelling and stationary linear instabilities, respectively, are analysed using the first Landau coefficient. It is shown that the subcritical instability can appear in the linearly stable regime. The present bifurcation theory shows that the flow is subcritically unstable to disturbances of long wave-lengths ($k_x \sim 0$) in the dilute limit, and both the supercritical and subcritical states are possible at moderate densities for the dominant stationary and traveling instabilities for which $k_x = O(1)$. We show that the granular plane Couette flow is prone to a plethora of resonances.[2]

[1]Shukla and Alam, *Phys. Rev. Lett.* **103**, 068001 (2009). Shukla and Alam, *J. Fluid Mech.* (2010, accepted).
[2]Shukla and Alam, *J. Fluid Mech.* (submitted, 2010)

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